Remarks

Claims 1-53 are pending in this application. Claims 1-53 have been amended in various particulars as indicated hereinabove. The claims were objected to because each element or step is not separated by a line indentation.

Claims 46-53 were objected to under 37 CFR 1.75(c) as being in improper form. Applicants believe that the referenced claims as amended are now in compliance with the requirements of 37 CFR 1.75(c).

Claims 1-45 were rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Nakamura (US Patent No. 6,236,904). Claims 7-8 were rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura in view of Tanigawa (U.S. Patent Application Publication No. 2001/0022930). These rejections are respectfully traversed for the following reasons.

It is well established that a claim is anticipated under 35 U.S.C. §102, only if each and every element of the claim is found in a single prior art reference.[1] Moreover, to anticipate a claim under 35 U.S.C. §102, a single source must contain each and every element of the claim "arranged as in the claim."[2, 3] Missing elements may not be supplied by the knowledge of one skilled in the art or the disclosure of another reference.[4] If each and every element of a claim is not found in a single reference, there can be no anticipation.

For an obviousness rejection to be proper, the Patent Office must meet the burden of establishing a prima facie case of obviousness. The Patent Office must meet the burden of establishing that all elements of the invention are disclosed in the cited publications, which must have a suggestion, teaching or motivation for one of ordinary skill in the art to modify a reference or combined references.[5] The cited publications

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1 *Veregal Bros. v Union Oil Co. of California, 814 F.2d 628, 631, 2USPQ2d 1051, 1053 (Fed. Cir. 1987).*
2 *Structural Rubber Prods. Co. v. Park Rubber Co., 749 F.2d 707, 716, 223 U.S.P.Q. 1264, 1271 (Fed. Cir. 1984).*
3 *Lewmar Marine Inc. v. Barient, Inc., 827 F.2d 744, 747, 3 U.S.P.Q. 2d 1766, 1768 (Fed. Cir. 1987), cert. denied, 484 U.S. 1007 (1988).*
4 *Titanium Metals Corp. v. Banner, 778 F.2d 775, 780, 227 U.S.P.Q. 773, 777 (Fed. Cir. 1985).*
5 *In re Sang Su Lee, 277 F.3d 1338, 61 USPQ2d 1430 (Fed. Cir. 2002).*

should explicitly provide a reasonable expectation of success, determined from the position of one of ordinary skill in the art at the time the invention was made.[6]

The invention, as defined in claim 1, is a substrate loading and unloading apparatus for automated loading and unloading of substrates, for example wafers on which integrated circuits are to be written by an electron beam lithography machine associated with the apparatus. Writing in such a machine is normally carried out in an evacuated space and the feed of substrates to and removal of substrates from an evacuated space imposes significant constraints, which are outlined on pages 1 to 3 of Applicants' specification. A major constraint is represented by the need to transport each substrate fixed to a holder and then the operations entailed in releasing each substrate, after it has been processed, from the holder and fixing a new substrate in its place. These operations are problematic to perform automatically as distinct from manually, particularly when account is taken of the fact that at some phase of the procedure the holder will have to be in a vacuum environment communicating with the evacuated space of the associated machine or of a substrate transfer station.

In the specific case of the described preferred embodiment, the evacuated space is that of a transfer station which has three points of communication, namely with a processing station (e.g. part of an electron beam lithography machine), a substrate feed (e.g. substrate magazine) and the substrate loading and unloading apparatus of the invention (see page 11, paragraph 1). The processing station, transfer station and loading/unloading apparatus are all - in one phase or another - disposed under vacuum. A new substrate from the magazine or other feed can enter the transfer station, pass to apparatus, be mounted on the holder in the apparatus, and travel together with the holder through the transfer station to the processing station. After processing, a reverse sequence of actions can take place, in which the processed substrate is demounted from the holder and subsequently discharged from the transfer station. The present invention is concerned only with the loading/unloading apparatus, in which fixing of a substrate on

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6 *In re Fine, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988); In re Wilson, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970);*
Amgen v. Chugai Pharmaceuticals Co., 927 U.S.P.Q.2d, 1016, 1023 (Fed. Cir. 1996);

and removal of a substrate from the holder can be carried out by an automated procedure. The apparatus can be constructed as stand-alone equipment in the form of an attachable module.

The loading and unloading apparatus as claimed accordingly comprises a) a substrate holder, b) a vacuum vessel and c) a release means. The substrate holder in turn comprises a substrate support table and a loading means for locating means for fixing the substrate on the table. In particular, the locating means is co-operable with the table to cause a supported substrate to be pressed against and thereby located on the table. Such a holder with a substrate located or fixed in place in this way provides a unit capable of transport and ensures that the substrate will not move during processing (the holder is, typically, fixed to a stage in a processing machine). The vacuum vessel defines a loading and unloading chamber in which loading and unloading of the holder are carried out and in which a vacuum environment can prevail. The chamber has a transfer port which can communicate with an evacuated environment externally of the vessel, for example the mentioned transfer station intermediate the loading/unloading apparatus and a substrate processing station, and which allows the substrate holder to pass in and out of the chamber, i.e. move between the external evacuated region and the vacuum environment in the chamber.

Finally, the release means serves to withhold the co-operation of the locating means and the table, i.e. to prevent a substrate from being pressed against the table by the locating means, and to provide temporary support of the substrate clear of the table, whereby movement of the substrate away from the holder and movement of a new substrate to the holder is permitted. Such movement of substrates to and from the holder can be carried out by, for example, a remotely actuable robotic handler (see page 11), which engages into the loading/unloading chamber of the vessel. The invention, however, is concerned with the loading and unloading of the holder within the chamber and fixing of substrates to and release of substrates from the holder in the chamber rather than with the actual movement of the substrate into and out of the chamber.

The principal citation US 6 236 904 (Nakamura) is concerned with something rather different, in particular - as it is entitled - a substrate conveying system. This

conveying system in the case of the Fig. 1 embodiment consists of a pillar 1 which runs along a horizontal guide 12 and which has a cantilever hand 2 on which a substrate 3 is carried and kept in place by suction (vacuum attraction). The object of moving the pillar along the guide is to introduce the substrate into a box 8. This box 8 has slots (column 4, lines 47, 48) and is apparently intended to be filled with a number - probably 10 to 20 - of wafers. In order to align each slot with an arriving substrate, the box 8 is moved up or down along a vertical post or guide 6. The box sits on a table 7 cantilevered from this post. Alignment is achieved by a vertically displaceable light barrier 9 which detects the front of the substrate - which because of its size may have flexed (e.g. sagged) and departed from the plane of the top of the hand 2 - and issues a signal to control the vertical drive of the box 8 / table 7 assembly. The focus of the invention is on the optical sensing of the substrate vertical position by way of the light barrier. The signals of the light barrier ensure that a slot of the box 8 is accurately positioned to receive the arriving substrate or, if analysis of signal data indicates excessive flexure of the substrate, stopping the forward motion of the substrate so as to avoid contact of the substrate with a part of the box.

Applicants asserts that there the Nakamura system does not disclose all the elements of the Applicant's amended claim 1, as outlined in the preceding paragraphs. Starting with the vacuum vessel, which is to provide a vacuum environment and which has a transfer port through which the substrate holder may be transferred between an external evacuated region and the internal vacuum environment of the chamber, Applicants cannot identify any such vessel in Fig. 1 of Nakamura and cannot find any reference in Nakamura to conveying or other actions carried out in a vacuum environment in a vacuum vessel. Conversely, it is evident that Nakamura does not provide for actions in a vacuum environment. The simple loading of the box 8 with a plurality of substrates, presumably to be taken away (when the box is filled) for bulk processing, does not call for a vacuum environment. If there is no vacuum environment, substrate loading and unloading can be carried out manually if desired. The Office Action draws attention, with regard to the feature of a vacuum vessel, to column 3, lines 59-67, and column 4, lines 1-12, of Nakamura, in the passage bridging the two columns, but

there is no mention in this passage of a vacuum chamber and, since the passage relates to Fig. 1, no such chamber can be seen in the drawing. The only mention of vacuum is in connection with retention of the substrate 3 on the hand 2, which is by vacuum attraction. The substrate is held on the hand by suction, but this has no relevance to a vacuum vessel with a chamber providing a vacuum environment and having a transfer port through which a substrate holder can move.

With regard to the substrate holder, Applicants' claim 1 comprises a substrate support table and locating means co-operable with the table to cause a supported substrate to be pressed against and located on the table. The table is represented in Nakamura by the hand 1 and the locating means is represented by whatever provides the vacuum attraction to fix (albeit by drawing rather than pressing) the substrate on the hand. Although the hand and vacuum attraction arrangement of Nakamura equate with the support table and locating means of the present invention to provide a substrate holder, this holder is only capable of movement around the pillar 1 and along the guide 12 and is at all times a captive component of the substrate conveying system. It clearly could not, even if the entire system were to be contained in a vacuum chamber, move in and out of a chamber. Apart from the absence of any purpose for a vacuum chamber, it would be impossible to provide a vacuum chamber with a transfer port, through which the hand 2 and substrate 3 could pass to an outside evacuated region, in the Nakamura system.

In fact, the hand 2 is only an intermediary in the process of transferring substrates to the box 8. It is the box, rather than the hand, that it is intended to transport a substrate and if anything were to pass through a transfer port for the purpose of movement of a substrate between different regions it would be the box, not the hand. The box is, of course merely a cassette, in which substrates are loosely inserted and are not held (located) in any way. In terms of function, the hand 2 does not really correspond with the substrate holder of the present invention.

Moreover, it should not be overlooked that if the hand 2 were to be located in a vacuum chamber the retention of a substrate on the hand by vacuum attraction would cease to be possible. The presence of a vacuum environment, which the vacuum vessel is

specifically required to provide, would negate the vacuum attraction of the substrate to the hand; there would no longer be atmospheric pressure above the substrate to provide the counter force to vacuum attraction.

Finally, Applicants claim 1 is directed to a release means for withholding the co-operation of the locating means with the table and providing a temporary support of a substrate clear of the table. This release means, in the case of Nakamura, would have to be something that switches off whatever arrangement provides the vacuum attraction of the substrate 3 onto the arm 2. Whilst the vacuum attraction can undoubtedly be switched on and off, the release means must also temporarily support the substrate clear of the support table, i.e. hand 2, and there is nothing in Nakamura that performs this task. There is also no requirement for the substrate to be supported clear of the hand 2 and if it were so supported, the entire system could not function. The substrate 3 remains on the hand 2 until it passes into a slot of the box 8. If the substrate were temporarily supported clear of the hand it could not be fed into the intended slot and the whole concept of Nakamura, which is to control vertical movement of the receiving box 8 and compensate for or react to flexure of the substrate 3 by way of signals from light barrier 9, would be lost. The Office Action suggests that Fig. 1 of Nakamura shows a release means fulfilling the described functions, but Applicants cannot discern any release means negating the vacuum attraction and temporarily supporting the substrate clear of the hand 2.

In the Applicants' respectful submission, therefore, Nakamura does not provide any teaching germane to substrate loading and unloading apparatus featuring a vacuum vessel with a vacuum chamber having an ingress/egress or transfer port and the Nakamura system does not have any requirement for such a vessel. Provision of such a vessel, for which there is no purpose, would conflict with the construction and operation of the Nakamura system. Further, Nakamura does not provide any teaching of a release means which operates to withhold fixing of a substrate to a support table of a substrate holder and to provide temporary support of a substrate clear of the table. The Nakamura substrate system is in a different field of art and is not concerned with loading and unloading of a substrate holder; Nakamura is concerned with serial loading of a multi-

compartment (slots) container and this does not impinge on the present invention as claimed.

Accordingly, Applicants believes that the invention as defined in the amended claim 1 of the present application, and consequently in its dependent claims appended thereto, is novel over the cited prior art of Nakamura. Additionally, for the reasons and arguments presented above, claims 7-8, which depend off amended independent claim 1, are non-obvious over the combination of Nakamura and Tanigawa.

It is believed that the present application is in condition for allowance. A Notice of Allowance is respectfully solicited. Should any questions arise, the Examiner is encouraged to contact the undersigned.

Respectfully submitted,

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